

feet, due largely to unstable base, resulting in the slab breaking badly and shifting out of position. At first our maintenance forces repaired the worst places with patches of cold mix material, but last season we decided that we were not keeping up with the destructive elements; so we placed a wearing surface over the entire width of 20 feet, first patching out the worst unevenness with a binder mix. This job was small and because of the considerable amount of material used in patching averaged a 3-inch loose course throughout, making a cost of about 83 cents per square yard. Bituminous concrete (Colprovia) was used.

We have resurfaced a number of old macadam roads with more or less heavy construction ranging from 3-inch retread course to 4-inch bituminous macadam with $\frac{3}{4}$ -inch rock asphalt wearing course. As previously stated, each particular job should be a study of its own, resulting in the selection of a material that will meet the several requirements involved.

Late last fall we placed 1,300 feet of 22-foot wearing surface on an oil mat using three different materials. These materials were: rock asphalt, synthetic rock asphalt (Crown Rock), and bituminous concrete (Colprovia), all laid cold and capable of being luted and planed. So far there is no apparent difference in results from these three materials, but by observing their future behavior we hope to learn more about their uses.

ENGINEERING REQUIRED IN IMPROVEMENT OF NEWLY ABSORBED TOWNSHIP ROADS

By M. T. Madden, Daviess County Surveyor

The subject assigned me is of much concern to the people who live in the rural districts, particularly to those who live alongside the many unimproved earth roads of the township which have been, since last September, under the control and management of the county commissioners and county highway superintendent. No doubt, the legislators in the called session of last year had many reasons for enacting the law giving to the county commissioners the care and responsibilities of the township roads. They probably had in mind greater possibilities for the betterment of the condition of those roads by relieving the township trustees of such responsibility and giving the task to a more powerful unit, a unit that has been strengthening itself for a number of years in the process of maintenance of the improved roads of the county. The county highway department has become well organized and by the use of modern power-operated equipment in the maintenance of the many improved roads, has accomplished much.

The building of the many county improved roads in Indiana has been accomplished under three separate laws. *First*, an order to build one or more projects following an election for such improvement or improvements. *Second*, the Three-Mile Road Law. *Third*, the County Unit Road Law. By the proper application of these laws, many roads have been built which, with few exceptions, have brought about conditions that are advantageous to the traveling public and for the transportation of the products of the soil. The usefulness of such roads have promoted many undertakings in the upbuilding of farm environments as well as cities and towns. The improvement of these roads covered a sufficient period of time so that the taxpayers were able to pay the cost without undue hardship.

The benefits derived from the use of such roads were much greater than their cost, especially when such roads were well built. Some may be surprised to know that we still have many townships in the state that are laboring under the disadvantages of having many miles of the old earth roads which discomfort and inconvenience the people living within a long radius of their location. We are deeply sympathetic with these people, many of whom are among our best citizens, who must suffer this great disadvantage and be penalized by such roads that are impassable for many weeks or perhaps months of the year (Fig 1).



Fig. 1. Such roads as this seriously handicap many rural communities.

It is a matter of social justice to which the old-time "Golden Rule" would forcibly apply that those enjoying the advantages of improved roads should do their utmost to aid those more unfortunate people on unimproved roads in gaining

the privileges and advantages of the year-round road service that the more favored ones now enjoy.

People living in the more congested districts of the state, people who have more assessables from which taxes or money may accrue for the building of roads or promoting schools and education, may as a result of their environment be unaware of the many disadvantages that prevail in the rural districts and of the great lack of opportunities which those in the rural districts deserve and should have. The civic value of these people in neglected rural districts may be given but slight consideration in normal times, but, when a great national crisis arises, they are sought out with a searchlight and urged or compelled to contribute their personal aid and financial co-operation in support of this great nation. So it is expedient that some of their needs in the way of road improvement should be thought of now.

There are other reasons why there are still so many miles of earth roads in this state. We find too often that in the past the improvement of such roads has been a mere make-shift, a very feeble step towards the betterment of road conditions. In many cases, miles of so-called improved roads have been built apparently with the idea that we would never again have heavy rains and that seepage on the hillsides or inclines was something of the past, and with no memory that the essential features in the road-building scheme are adequate grading and drainage. Because of this forgetfulness or lack of foresight, we have been forced to rebuild many of the so-called improved roads in our counties. The maintenance of many other roads of a similar type requires so much time and money that road funds are soon exhausted on the care of such improvised roads.

Surveys, plans, specifications, and inspection should all be handled by competent engineers. Too often, in the process of construction, those plans are evaded, forgotten, or tortured all out of semblance to their original form. Sometimes they are set aside by the courts which are not fully advised or informed as to the importance of the engineering details of plans and specifications for road improvement. We hope that in every instance the courts under such a strain have been guided with an honest impulse rather than by the idea of favoring a certain personnel, but in the face of such decision in perhaps all instances, the taxpayers and traveling public are the sufferers. It is a sad thing to attempt to travel a road where we find that many dollars of the hard-earned money of the taxpayers have been spent thoughtlessly or foolishly. There never was a time that the greatest skill, training, and experience obtainable were as necessary as they are today in attempting to improve roads. The best lights among our experienced engineers are none too good or competent to plan the future of the unimproved roads.

All of this can not be accomplished in one breath, but the most needed, the most used roads should receive, of course, the first possible attention. The grade and drainage which are the absolutely necessary factors in improving or maintaining roads must be scientifically cared for, or all other efforts will be in vain. A haphazard way of caring for these roads should not be tolerated, neither should an irresponsible person or persons be placed in charge. When the grade and drainage (Fig. 2) are carefully taken care of and where it is



Fig. 2. Much work is needed in regrading and draining these narrow township earth roads.

impossible, because of financial conditions, to provide road metal to stabilize the wearing surface, the earth road under proper maintenance will accommodate considerable traffic.

In our county, the first thing we must combat is the narrow width of our township roads which were laid out in those days when a good team and wagon or buggy was the necessary asset for travel over roads. Some people seem to question the need of an engineer at all in road improvement. They will tell you that in making cuts and fills the general appearance of the work, or, as they say, the eye will tell you the amount of cutting and filling needed without any definite plan in mind. In the final analysis, the men who pay the bill and travel the road suffer for poor road construction. They should have some knowledge or some way of knowing whether they are being or will be imposed upon or whether they will be benefited. There is no way of knowing unless you have carefully prepared plans and specifications so as to define anticipated improvements. When the engineer prepares his plans and specifications for the improvement of a road, he should have in mind the clearly defined needs of the road, not for the present day only, but for many years hence.